

Two new species of the genus *Anelpistina* (Insecta: Zygentoma: Nicoletiidae) from Mexican caves, with redescription of the genus

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Abstract.—Two new species of the genus *Anelpistina* are described, *A. inappendicata* and *A. cuaxilotla*. Of these two, *A. inappendicata* lacks the articulated submedian appendages found in urosternite IV of males, which are diagnostic characters of genus *Anelpistina*. Analysis of other characters shows that this species has close affinities with members of genus *Anelpistina*, and therefore a new re-description of the genus is provided to include this species.

Insects of the family Nicoletiidae are common inhabitants of caves in México. Numerous species of troglobites and troglaphiles have been collected from this area, but with few exceptions, they await description (Reddell 1981). During the exploration of several caves in the states of Guerrero and Morelos, México, several specimens of this family were collected and are described here, thus contributing to the knowledge of the cave fauna of the region.

Definition of genus *Anelpistina* by Silvestri (1905) is based on the articulated submedian appendages found in urosternite IV of males. Organisms who are closely related to species of genus *Anelpistina*, but lack such appendages, would be incorrectly placed in genus *Cubacubana* (Wygodzinsky & Hollinger 1977). For this reason, genus *Anelpistina* is redescribed using more characters to include species, such as the one described in this paper, that lack the appendages.

Materials and Methods

Detailed descriptions of the caves can be found in Hoffman et al. (1986), Diamant & Espinasa-Pereña (1991), and in Espinasa-Pereña (1989). Organisms collected were crawling on floor or under rocks. They were placed into a vial with 70% alcohol or were

taken alive to the laboratory. Dissections were made with aid of a stereo microscope and the different parts of the body were mounted in fixed preparations with Hoyer's solution.

Comparison with *A. boneti* was done with specimens collected by author from their type localities of Juxtlahuaca cave, Colotlipa, Guerrero, México, and from a new locality, the cave of "Iglesia-Mina superior", San Juan, Tepoztlán, Morelos, México. Comparison with other species was based on published material. All illustrations were made with aid of a camera lucida attached to a compound microscope.

Types were deposited in the following collection: LESM-DB-MEX (Laboratory of Ecology and Systematic of Microarthropods. Department of Biology, Faculty of Sciences, UNAM. México D. F.). Catalog numbers: ZYG-3 for *Anelpistina inappendicata* and ZYG-4 for *Anelpistina cuaxilotla*.

Anelpistina Silvestri, 1905

Diagnosis.—Member of subfamily Cubacubaninae without scales. Submentum without conspicuous lateral lobes bearing glandular pores. Urosternite IV of adult male with 1 + 1 articulated submedian appendages and/or with point of insertion of

parameres in urosternum IX deep, normally with internal face of coxal processes with macrochaetae more or less sclerotized.

Description emending.—Body slender, approximately parallel-sided, thorax slightly but distinctly wider than abdomen. Antennae and body are of similar length. Head with approximately 8 + 8 macrochaetae in border of insertion of antennae. Pedicellus of male normally with 3 clusters of unicellular glands, one of them very long.

Mouthparts not specialized. Mandibles strongly sclerotized apically and with usual teeth, typically with more than 4 macrochaetae. Galea apically with several sensory pegs. Lacinia heavily sclerotized distally; first process of lacinia pectinate. Labium without prominent lateral lobes. Next to last article of labial palp more or less with a rounded bulkiness.

Tarsus longer or equal in length to tibia. Tarsi with 4 articles. Praetarsi with 3 simple claws, median claws glabrous, slender, and smaller than lateral claws.

Abdominal sterna II–VII subdivided into coxites and sternite. Sterna VIII and IX of male entire. Coxites on segments II–IX with stylets. Eversible vesicles on segments II–VI, pseudovesicles on VII. Urosterna III simple. Urosterna IV in males with or without 1 + 1 articulated submedian appendages. Point of insertion of parameres in urosternum IX generally deep except in *A. weyrauchi* (Wygodzinsky 1959) and to certain degree in *A. ruckeri* (Silvestri 1905), normally with internal face of coxal processes with macrochaetae more or less sclerotized. Cerci of male with modified spines.

Normal parameres, not subdivided or somewhat constricted apically. With specialized setae on apex. Opening of penis longitudinal.

Type species.—*Anelpistina wheeleri* Silvestri 1905.

Remarks.—According to Silvestri's (1905) definition of genus *Anelpistina*, the main difference between this genus and the other members of the subfamily Cubacu-

baninae is the articulated submedian appendages in the urosternite IV of males. Specimens that are closely related to species of the genus *Anelpistina*, but lack such appendages could incorrectly be placed in the genus *Cubacubana*. Therefore a broader re-description is given to include these specimens.

With the new re-description, genus *Anelpistina* differs from *Texoreddellia* (Wygodzinsky 1973) by the absence of scales and of a conspicuous process of the pedicellus in males, as well as by the presence of modified spines on the cerci of males. From *Altonicoletia* (Mendes 1992) by the presence of stylets in urosternite II. From *Neonicoletia* (Paclt 1979) by the aspect of the endopodium. *Prosthecina* (Silvestri 1933) and *Cubacubana* agree with *Anelpistina* in the possession of modified spines on the cerci of males, but *Prosthecina* has a submentum with conspicuous lateral lobes bearing numerous glandular pores. *Cubacubana* lacks 1 + 1 articulated submedian appendages in urosternite IV and the point of insertion of parameres in urosternum IX is shallow without more or less sclerotized macrochaetae in the internal face of coxal processes. *Anelpistina* has either or both the appendages and the deep insertion.

Anelpistina inappendicata, new species
Figs. 1A–F, 2A–G

Type material.—México, Guerrero State, Tetipac municipality, Agua Brava cave (17 meters deep, 819 meters long). ex soil, 7 Aug 1988, 25 Mar 1989 and 15 Mar 1991, L. Espinasa col. Male holotype, 4 male paratypes and ten female paratypes.

Description.—Maximum body length 13.5 mm. Maximum length of antennae 9.0 mm, of caudal appendages 9.0 mm. When complete, antennae and caudal appendages measure more or less the length of body. General color light yellow to white.

Head with macrochaeta and microchaeta as shown in Fig. 1F, with approximately 8 + 8 macrochaetae on border of insertion of

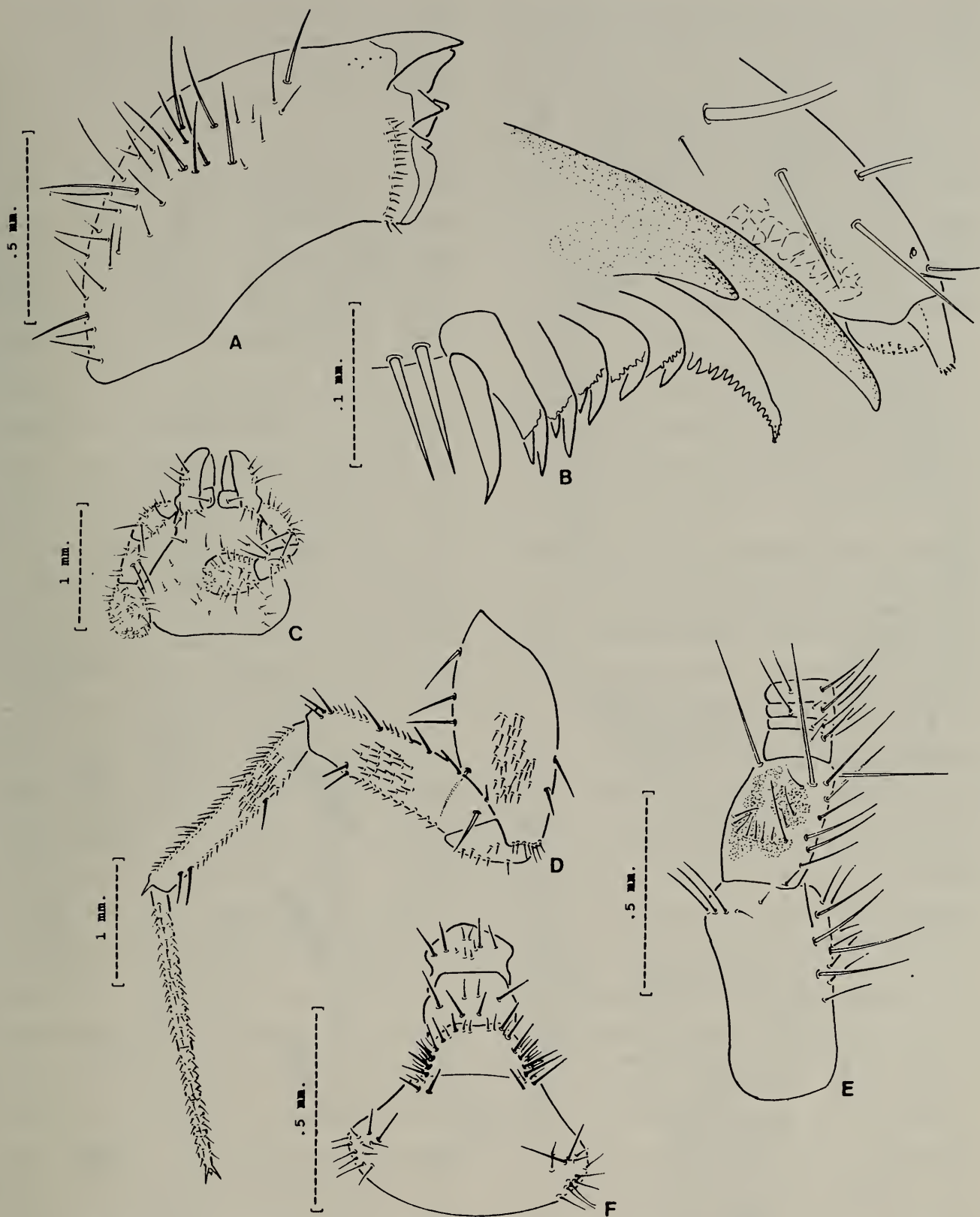


Fig. 1. *Anelpistina inappendicata* n. sp.: A, Mandible; B, Apical portion of maxilla; C, Labium with palp; D, Hind leg, microchaetae partially shown; E, Male. Basal portion of antenna; F, Head.

antennae. Basal article of antennae in males without projections. Pedicellus of antennae of male as shown in Fig. 1E, with numerous clusters of unicellular glands. Female basal articles of antennae simple.

Mouthparts relatively long, apex of maxilla as shown in Fig. 1B. Labial palp long, apical article longer than wide. Labium and first article of labial palp with macrochaetae. Mandibles with approximately 8 ma-

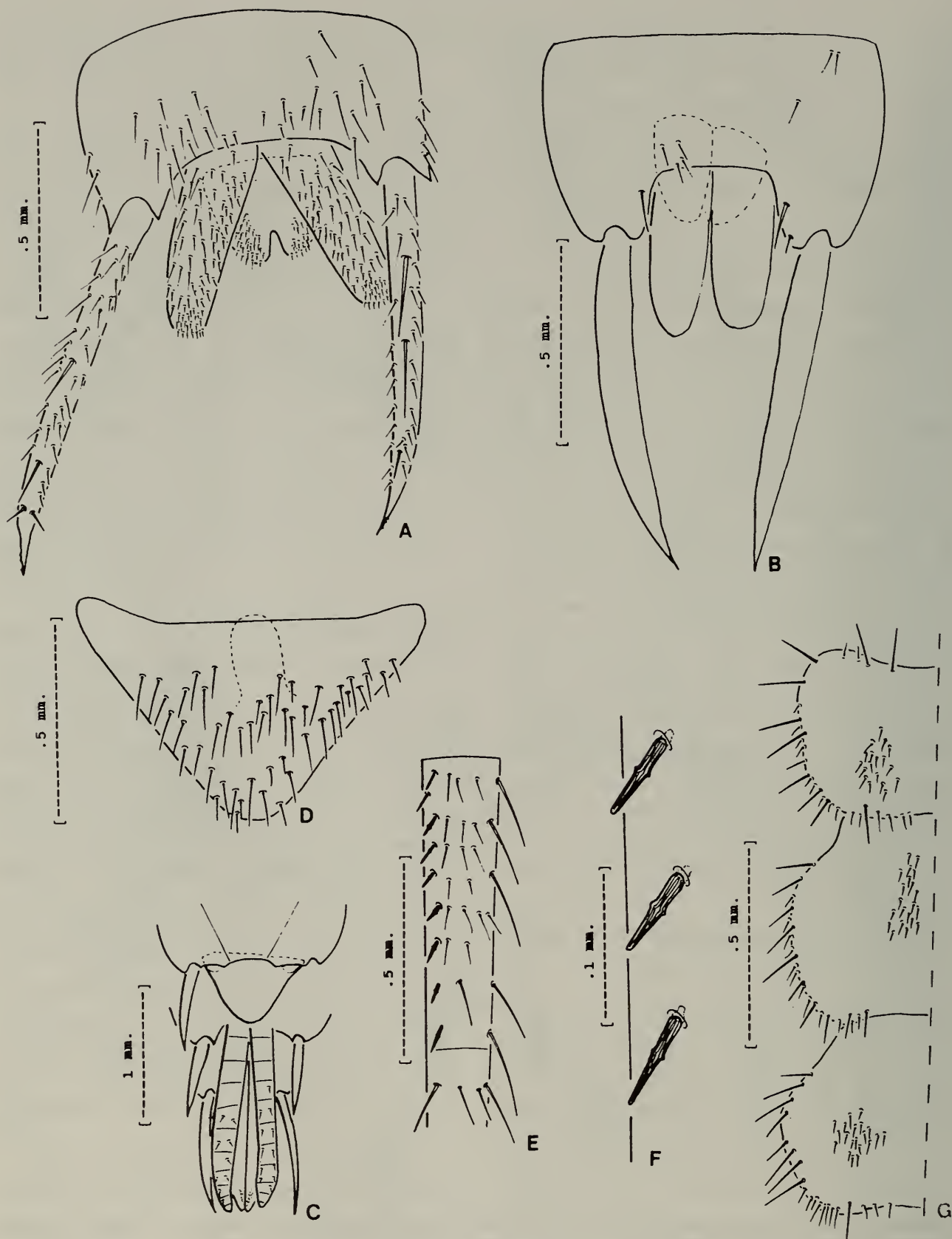


Fig. 2. *Anelpistina inappendicata* n. sp.: A-B, Male. Genital area; C, Ovipositor and subgenital plate; D, Subgenital plate; E, Basal portion of cercus; F, Modified spines of cercus, higher magnification; G, Thoracic nota, dorsal.

crochaetae, some very small pegs on larger tooth (Fig. 1A). Legs as shown in Fig. 1D, moderately elongate; hind tibia approximately 7× longer than wide. Claws of normal size.

Cerci of male with a longer than wide basal article, a very long second one bearing numerous spines, followed by numerous short articles of simple chaetotaxy. Spines along most of second article and of similar size. Spines with medial enlargement in form of ring (Fig. 2E, F). Female cerci simple.

Thorax with short macrochaetae, very abundant on lateral borders, 1 + 1 submedian distinct macrochaetae, apart from several setae of varied sizes, in posterior border of pro-, meso- and metanotum. 2 + 2 also on anterior border of pronotum (Fig. 2G).

Urotergite X almost straight in both sexes, posterior angles with few macrochaetae of varied sizes, length of inner macrochaetae almost equal to distance between them.

Abdominal terga and sterna as in other members of genus. Abdominal sterna II–VII subdivided into coxites and sternite. Sterna VIII and IX of male entire. Urosternum III and IV of male without modified coxites. Urosternum VIII of male shallowly emarginate on posterior margin. Urosternum IX of male straight behind without a row of sensory cones, but point of insertion of parameres in urosternum IX is deep, with internal face of coxal processes with macrochaetae more sclerotized (Fig. 2A, B). Stylets II–VIII as usual for subfamily. Stylets IX larger than others, with 2 or 3 macrochaetae and an extra subapical pair. Terminal spine with small teeth. In males and females styles without modifications.

Penis and parameres as shown in Fig. 2A, B. Parameres attaining $\frac{1}{2}$ of stylets IX, divergent and slightly concave. Surface of parameres with short setae. Subgenital plate of female triangular, twice as wide as it is long (Fig. 2C, D). Ovipositor barely surpassing apex of stylets IX. Gonapophyses with approximately 12 articles.

Postembryonic development not very

complex, with younger instars almost identical to older ones except for size. In smaller sized males (9 mm.), spines on cerci lack medial enlargement in form of a ring (it is unknown if younger instars than those collected lack spines). In females, length of ovipositor increases proportionally with body size until at body length of 9.5 mm, ovipositor barely surpasses apex of stylets IX. Longer body sizes of up to 13.5 mm. did not bring an increase of size of ovipositor when compared to stylets IX.

Etymology.—In/appendicata = without/appendages. Makes reference to the lack of articulated submedian appendages in this species, which are normally found in the urostermite IV of males in the genus *Anelpistina*.

Remarks.—The characters that allow us to identify *A. inappendicata* as more closely related to species of the genus *Anelpistina* than to *Cubacubana*, even though it lacks such appendages are: Antennae and body are of similar length, as in *Anelpistina*, while in *Cubacubana* the antennae are twice as long; Pedicellus of antennae with three clusters of unicellular glands, one of them very long. This is in general the case in *Anelpistina*. The norm in *Cubacubana* is four clusters bordered by a “U” shaped row of microchaetae; Head with approximately 8 + 8 macrochaetae in the border of insertion of the antennae, as in some *Anelpistina*, while *Cubacubana* normally has 5 + 5; Lateral borders of thoracic nota with approximately eight macrochaetae. This is closer to most *Anelpistina*, with approximately five macrochaetae, than to *Cubacubana*, with approximately three; Mandibles with more than four macrochaetae, as in some *Anelpistina*, while in *Cubacubana* there are typically four; The next to last article of the labial palp without a rounded bulkiness. In this character *A. inappendicata* is, on the contrary, more similar to species of the genus *Cubacubana* whose article is straighter, while in *Anelpistina* they are bulky. This character could be explained by a loss of bulkiness in *A. inap-*

pendicata; Tarsus longer than the tibia. Although this is generally the case for *Cubacubana*, in *Anelpistina* it is longer to equal; Point of insertion of parameres in urosternum IX deep, with internal face of coxal processes with macrochaetae sclerotized. This deep insertion and the sclerotized macrochaetae are absent in *Cubacubana*. On the contrary, the deep insertion is present in all the species of *Anelpistina*, except *A. weyrauchi*, and the sclerotized macrochaetae are present in most of the species.

Anelpistina inappendicata and the other North American species of *Anelpistina* have in common a deep insertion of the parameres and other intermediate characteristics, which are absent in the South American species (*A. weyrauchi*). It is likely therefore that the divergence of *A. inappendicata* from the species of this genus happened after the separation of *A. weyrauchi* from the group, but before the radiation of the other described North American species of *Anelpistina*.

Anelpistina decui (Wygodzinsky & Hollinger 1977), new combination *Cubacubana decui* Wygodzinsky & Hollinger, 1977:320–322, figs. 4–6; Mendes, 1986:341; Espinasa, 1991:6, 14.

Remarks.—Although *A. decui* lacks the articulated submedian appendages on urosternite IV of the male, this species has closer affinities with members of *Anelpistina* than it does to *Cubacubana* because its point of insertion of parameres in urosternum IX is deep and the internal face of coxal processes has sclerotized macrochaetae.

An analysis of other characters present in *A. decui* that allow us to identify it as more closely related to species of genus *Anelpistina* than to *Cubacubana*, even though it lacks such appendages, is given based on the illustrations and description of Wygodzinsky (1977): Antennae twice as long the length of the body, as in *Cubacubana*, while in *Anelpistina* antennae are of similar length. Even though this character would appear to make it closer to *Cubacubana*, its

longer antennae may be due to a secondary adaptation to its cavernicole environment; Pedicellus of antennae with two long clusters of unicellular glands and no “U” shaped row of microchaetae. In *Anelpistina*, normally there are three clusters, one of them very long. The norm in *Cubacubana* is four clusters bordered by a “U” shaped row of microchaetae; Lateral borders of thoracic nota with approximately five macrochaetae, as in most *Anelpistina*, while *Cubacubana* approximately has three; The next to last article of the labial palp with a somewhat rounded bulkiness, as in *Anelpistina*, while in *Cubacubana* it is straighter; Cerci of male with four spines; a small one, a long and strong one, another small and a very long curved one. Although in both *Anelpistina* and *Cubacubana* there is diversity in morphology of spines, this particular arrangement of four spines is exactly the same for most species in genus *Anelpistina*.

Other characteristics that could further establish to whom the species is more closely related, such as the number of macrochaetae on mandibles and on the border of the insertion of antennae, regrettably could not be obtained from the illustrations of Wygodzinsky (1977).

Anelpistina cuaxilotla, new species
Figs. 3A–G, 4A–D

Type material.—Type locality: México. Guerrero: Apetlanca, Cuaxilotla town, in the penumbra zone (Entrance to 120 m) of “Cuaxilotla” cave, under rocks. 6 Jun 1987 and 23 Aug 1987. L. Espinasa col. Male holotype, ten male paratypes and 12 female paratypes. Other localities: México, Morelos state, Tepoztlán municipality, San Juan town, “San Juan” or “Sistema Ferrocarril-Mina inferior” volcanic cave system, under rocks. 21 Jan 1979. R. García col. One male paratype.

Description.—Maximum body length 12.0 mm. Maximum length of antennae 6.0 mm, of caudal appendages 5.0 mm. When complete, antennae and caudal appendages

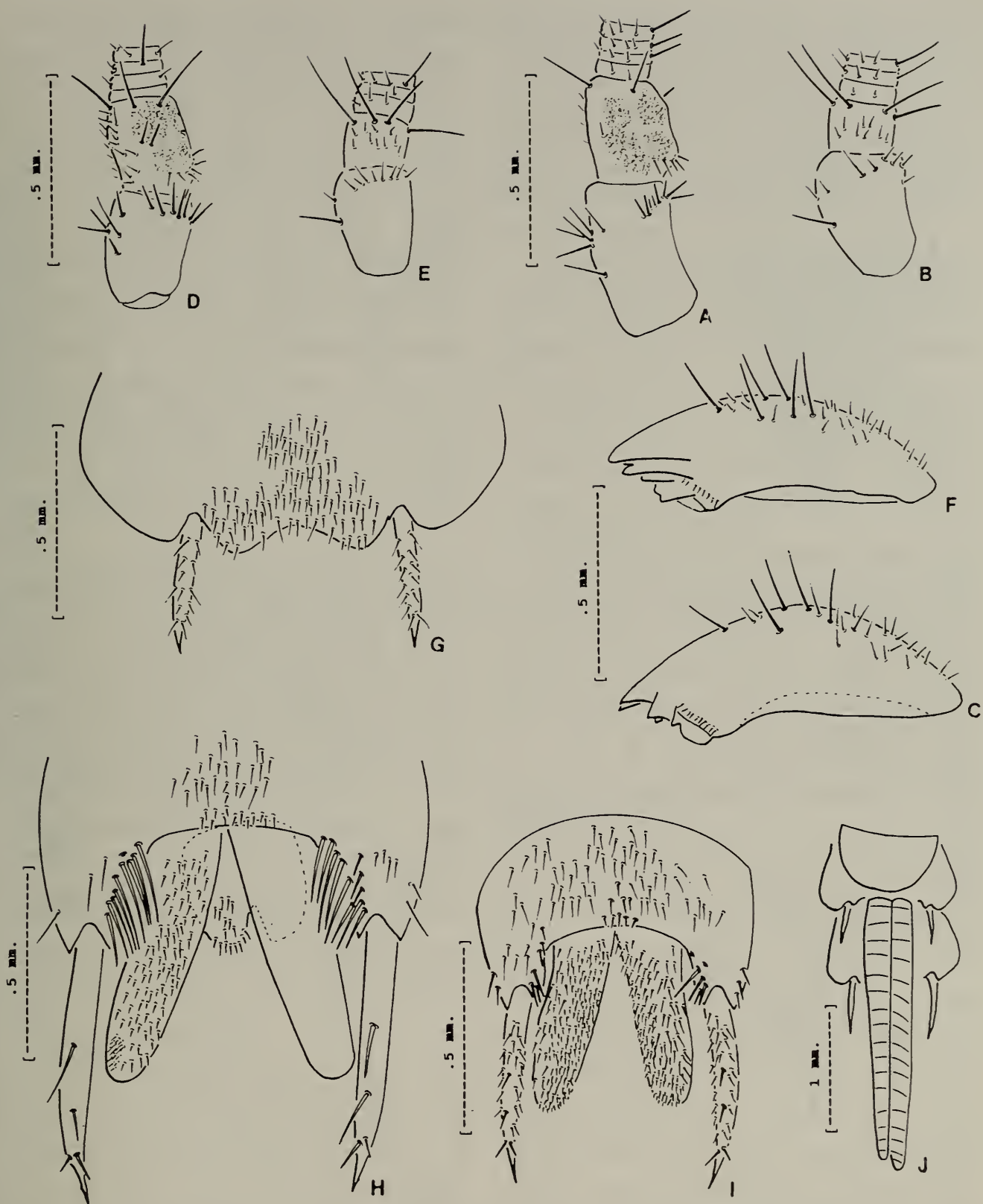


Fig. 3. A–C, *Anelpistina boneti* (Wygodzinsky), D–G, *Anelpistina cuaxilotla* n. sp.: A, Male, basal portion of antenna; B, Female, basal portion of antenna; C, Mandible. D, Male, basal portion of antenna; E, Female, basal portion of antenna; F, Mandible; G, Male, abdominal sternum VIII; H, Male from “San Juan” cave, genital area; I, Male from “Cuaxilotla” cave, genital area; J, Ovipositor and subgenital plate.

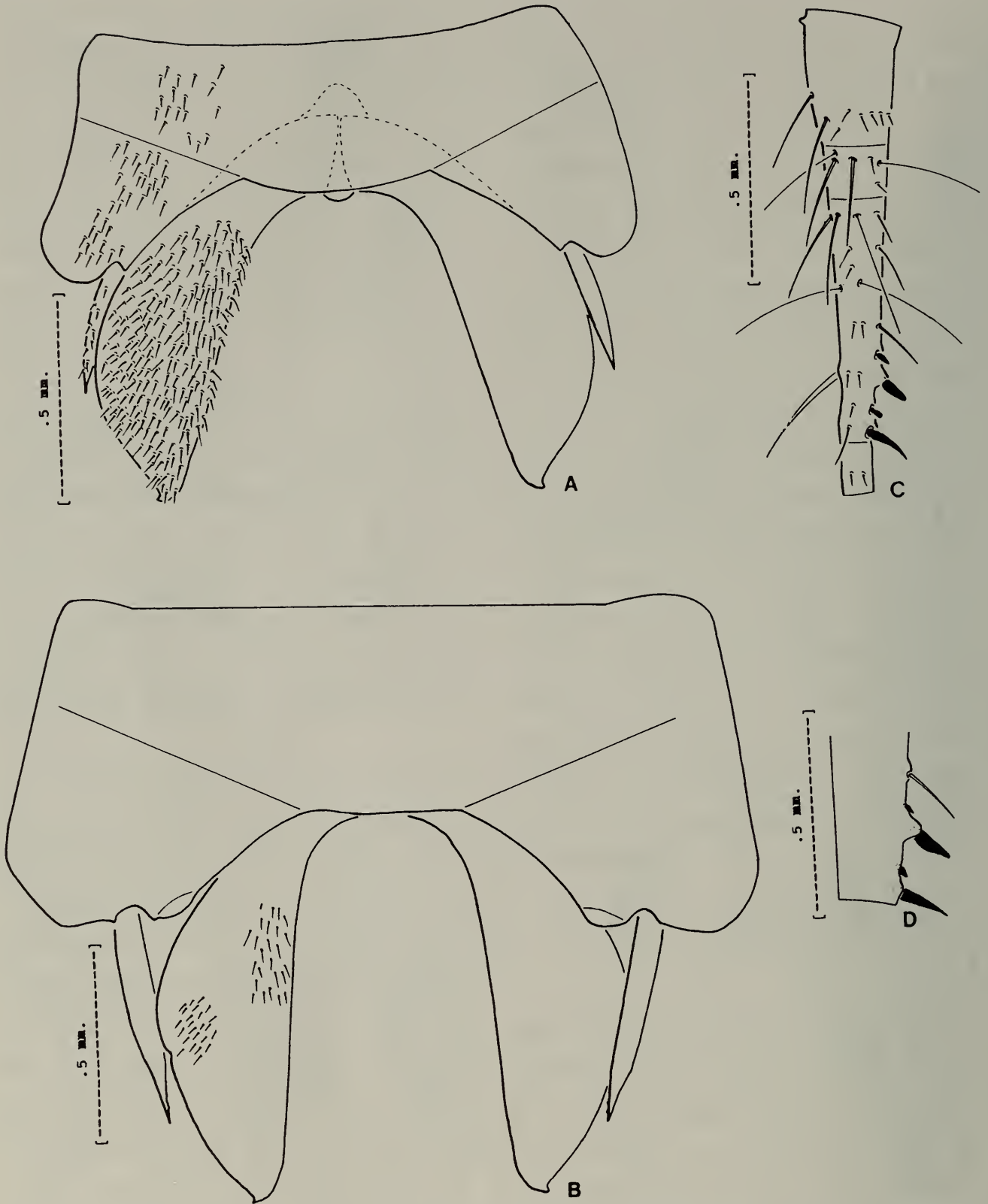


Fig. 4. *Anelpistina cuaxilotla* n. sp.: A, Male from "Cuaxilotla" cave, appendages of urosternite IV; B, Male from "San Juan" cave, appendages of urosternite IV; C, Male from "Cuaxilotla" cave, modified spines of cercus; D, Male from "San Juan" cave, modified spines of cercus.

measure less than length of the body. Setae on body strong, long and very abundant. General color light yellow to white.

Head with macrochaetae and microchaetae

similar to Fig. 1F. Basal article of antennae in males slightly longer than pedicellus, but shorter than in *A. boneti*. In the female it is also shorter than in *A. boneti*

(Fig. 3A, B, D–E). Pedicellus of male as shown in Fig. 3D, with numerous clusters of unicellular glands. Female basal articles of antennae simple.

Mouthpart appendages relatively long, very similar to *A. boneti*. Apex of maxillary palp with two conules, one longer than wider and the other wider than longer. Labial palp long, apical article barely longer than wide and only slightly longer than next to last article. This penultimate article with bulkiness with two macrochaetae. Labium and first article of labial palp with macrochaetae. Mandibles without very small pegs on bigger tooth and chaetotaxy as in Fig. 3F. Legs as in *A. boneti*, with sclerotized macrochaetae on tibia. Claws of normal size.

Cerci of male with a longer than wide basal article, second article wider than longer and a very long third one bearing 4 spines in distal portion, followed by numerous short articles of simple chaetotaxy. Spines consist of a very small one, a strong, subacute one, another very small, and a long, acute and slightly curved one (Fig. 4C, D). Cerci of female simple.

Abdominal sterna and terga as in other members of the genus. Setae long and numerous. Thorax with shorter setae than on urosterna. Lateral borders as in *A. boneti*, with 4–5 macrochaetae. Urotergite X long and almost straight in both sexes, posterior angles with 2 + 2 macrochaetae and a few relatively strong setae.

Appendages of urosternum IV of male very long and robust, acute on apex. Their longest diameter equals the length of the stylets of this segment (Fig. 4A, B).

Urosternum VIII of male long and shallowly emarginate on the posterior margin (Fig. 3G), slightly deeper than in *A. boneti*.

Urosternum IX of male with setae abundant. Behind insertion of parameres, in the center, with a small group of short, sclerotized and spiniform setae. Internal face of coxal processes with irregular row of 5 spiniform macrochaetae highly sclerotized

(Fig. 3I). In the only male individual collected from cave of San Juan (Sistema Ferrocarril-Mina inferior), this row is of ten macrochaetae (Fig. 3H). It is not known if this difference is due to population differences or because the individual of San Juan, being the biggest (12.0 mm) corresponds to an older instar.

Stylets similar to *A. boneti*. Stylets IX bigger than the others. Penis and parameres as shown in Fig. 3H, I. Parameres attain the length of stylets IX. Surface of parameres with short setae.

Subgenital plate of female rounded, with the apex slightly flat (Fig. 3J). Ovipositor surpassing apex of stylets IX by twice the length of stylets. Gonapophyses with approximately 17 articles.

Postembryonic development not very complex with younger instars almost identical to older ones except for size. In male, appendages of urosternite IV appear very small at a length of approximately 6.0 mm and acquire adult morphology at a length of 7.0 mm. In the longest individual (12.0 mm) only a slight increase in the proportions of sexual secondary characters is observed.

Female development not well known because all females collected measure more than 7.5 mm, when length of ovipositor already surpasses apex of stylets IX by one and a half to two times its size.

Etymology.—Cuaxilotla. Makes reference to the type locality, “Cuaxilotla” cave.

Remarks.—The closest species to *Anelipistina cuaxilotla* are *A. bolivari*, *A. anophtalma*, and *A. boneti*. In males of *A. cuaxilotla*, urosternum VIII is shallowly emarginate on posterior margin, while in *A. bolivari*, emargination is narrow and deep. Other characteristics that differentiate these two species are the spines in the cerci and the abundance of setae in terga and sterna. From *A. anophtalma* it differs because in this species, urotergite X is deeply emarginate on the posterior margin, appendages of urosternite IV are thin and ovipositor is short, while in *A. cuaxilotla*, urotergite X is

almost straight, appendages are broad and ovipositor is long. For *A. boneti*, the closest species to *A. cuaxilotla*, the main difference is that in *A. boneti* the appendages of urosternite IV are thin, while in *A. cuaxilotla* they are broad. Other characteristics that differentiate them are that in the former, the cerci have three spines (although some individuals from "Iglesia-Mina superior" cave in Morelos have 4) while in *A. cuaxilotla* they have four; the basal article of the antennae in males and females is proportionally longer than the pedicellus in *A. boneti* than it is in *A. cuaxilotla* (Fig. 3A, B, D, E); and the chaetotaxy of the mandible (Figs. 3C and F). To establish these differences with precision, a large number of individuals of *A. boneti* collected from the type locality by the author were compared to the individuals of *A. cuaxilotla*.

The somewhat overlapping distribution of *A. cuaxilotla* and *A. boneti* is intriguing. The latter was reported to a wide distribution comprising the states of Guerrero, Morelos, D.F. and even Habana island in the Gulf of California (Wygodzinsky 1946), while *A. cuaxilotla* has been found in Guerrero and Morelos. Wygodzinsky (1946) initially distrusted such a big geographic distribution of *A. boneti*, although repeated studies failed to show differences between samples of different origins ("Desconfiamos inicialmente da grande distribuição da espécie, repetidos exames detalhados falharam de demonstrar diferenças entre os exemplares de procedência diferente").

Regardless of whether organisms from the Gulf of California are indeed *A. boneti*, the author of the present paper has found a locality where both species can be found in close proximity. Individuals that clearly belong to *A. boneti* have been collected in the cave system of the "Iglesia-Mina superior" (Morelos, Tepoztlán, San Juan). This cave system is only tens of meters away from the cave system of Ferrocarril-Mina inferior, where an individual of *A. cuaxilotla* was found. Individuals of both species from these two caves can clearly be differentiated

morphologically, especially because samples of both contain mature males.

It is currently not known if the presence of four spines on the cerci in males of *A. boneti* from Iglesia-Mina superior cave, instead of three spines as it is the norm for this species, reflects variation within the species, or if it instead reflects local hybridization between both species in these neighboring caves.

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